

DOCUMENT RESUME

ED 280 407

HE 020 258

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TITLE Marketing, Investment, and Institutional Renewal in the Academic Research Sector. AIR 1986 Annual Forum Paper.
PUB DATE Jun 86
NOTE 27p.; Paper presented at the Annual Forum of the Association for Institutional Research (26th, Orlando, FL, June 22-25, 1986).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)
EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Budgets; College Faculty; Departments; Economic Factors; Equipment; Expenditures; Fund Raising; Higher Education; Income; Institutional Research; Investment; Marketing; *Models; *Money Management; Operating Expenses; Philanthropic Foundations; *Private Financial Support; Program Costs; *Research Administration; *Research Universities; Simulation
IDENTIFIERS *AIR Forum; *Revitalization

ABSTRACT

The problem of selective renewal of basic research capability within a professional (medical) school of a major research university is addressed. Attention is directed to a strategy and process for conducting such a revitalization that includes marketing the program in a partnership modality to a local foundation. Reasons that the foundation helped to rebuild the school's basic research strength are identified, including the relationship between the school and the local health industry. The net financial impact on the school of four alternate revitalization scenarios was evaluated using a system dynamics simulation model that is programed in "STELLA" and runs on Apple's Macintosh computer. The model takes into account research income, operating expenses, expenditures, dollars in the funds reserve, equipment needs, and faculty variables such as hiring costs. The model was used to evaluate the impact, in terms of external funds generated, resulting from alternate levels of investment in a simulated department. The return was viewed as the research and tuition income generated by departmental activities, while investment was the annual operating budget allocated by the school plus startup dollars. (SW)

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Marketing, Investment, and Institutional Renewal
in the Academic Research Sector

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for Management Research, Policy Analysis, and Planning

This paper was presented at the Twenty-Sixth Annual Forum of the Association for Institutional Research held at the Marriott Orlando World Center, Orlando, Florida, June 22-25, 1986. This paper was reviewed by the AIR Forum Publications Committee and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC Collection of Forum Papers.

Ann K. Dickey, Chair
Forum Publications Editorial
Advisory Committee

Abstract

This paper addresses the problem of selective renewal of basic research capability within a professional school of a major research university. It describes a strategy and process for carrying out such a revitalization which includes marketing the program in a partnership modality to a local foundation. Studies carried out on a system dynamics simulation model, to provide return on investment analyses, are an important component of the process.

Marketing, Investment, and Institutional Renewal
in the Academic Research Sector
Perspective

A research university has been described as one "whose mores and practices make it clear that enlarging and disseminating knowledge are equally important activities and that each is done better when both are done in the same place by the same people" (Rosenzweig and Turlington, 1982, p.1). With the present climate of constrained resources, it is not unusual for academic departments in such institutions to undergo extended periods of reduced faculty turnover or contraction which results in reduced competitiveness for research awards. This can lead to an environment of steady decline. Facilities and equipment become outdated because fresh research funds are not flowing in to help pay for upgrades. Since fewer active programs are ongoing, data and research results on which to base future proposals are diminished, thereby making competition for funding additionally difficult. Under these circumstances, institutional resources are further constricted because of reductions in indirect cost recovery income. Attitudes of university personnel in such a situation are often adversely affected (Davis, 1985), and an inevitable result is that it is difficult to recruit top people to such an environment, further hampering a reversal of the trend.

During the late 1970's, departmental deterioration similar to that described above had developed in several of the basic science departments of the School of Medicine at Case Western Reserve University (CWRU). The faculty distribution was heavily weighted toward the senior end of the scale, and the average generation of external research support was waning. This is

consistent with analyses conducted by the authors relating generation of research grants to faculty age. Figure 1 displays these results on a relative scale, and indicates that research funding is maximal during a relatively broad period of middle career years. Due to the inevitability of aging, it is crucial to have younger faculty continually in the pipeline. Because of other pressures, the School had held the allocation of unrestricted funds to these departments' budgets virtually constant for some time, such that in combination with declining research funding, equipment and facilities had significantly depreciated. These factors further fueled the decline in externally generated research funding.

To overcome the atrophic condition that had set in, a three pronged strategy was developed which included reallocation of institutional funds, a major capital campaign to increase endowment and upgrade equipment and facilities, and a programmatic approach to a major local foundation. By its emphasis on mission rather than symptoms, this effort parallels the experience at Bradford College described by Levine (1985). Although all three factors have been important to the success of this venture, this paper focuses on the logic and analytical studies which provided some of the underpinnings for the approach to the foundation.

Marketing

In contrast to most university marketing efforts which are directed at the problem of declining enrollment (Maust, 1985), the program discussed in this paper focused on forging a partnership with a local foundation to rebuild the School's basic research strength. Although basic research support is not considered as part of its usual mission, the foundation elected to participate in this endeavor based on a number of points.

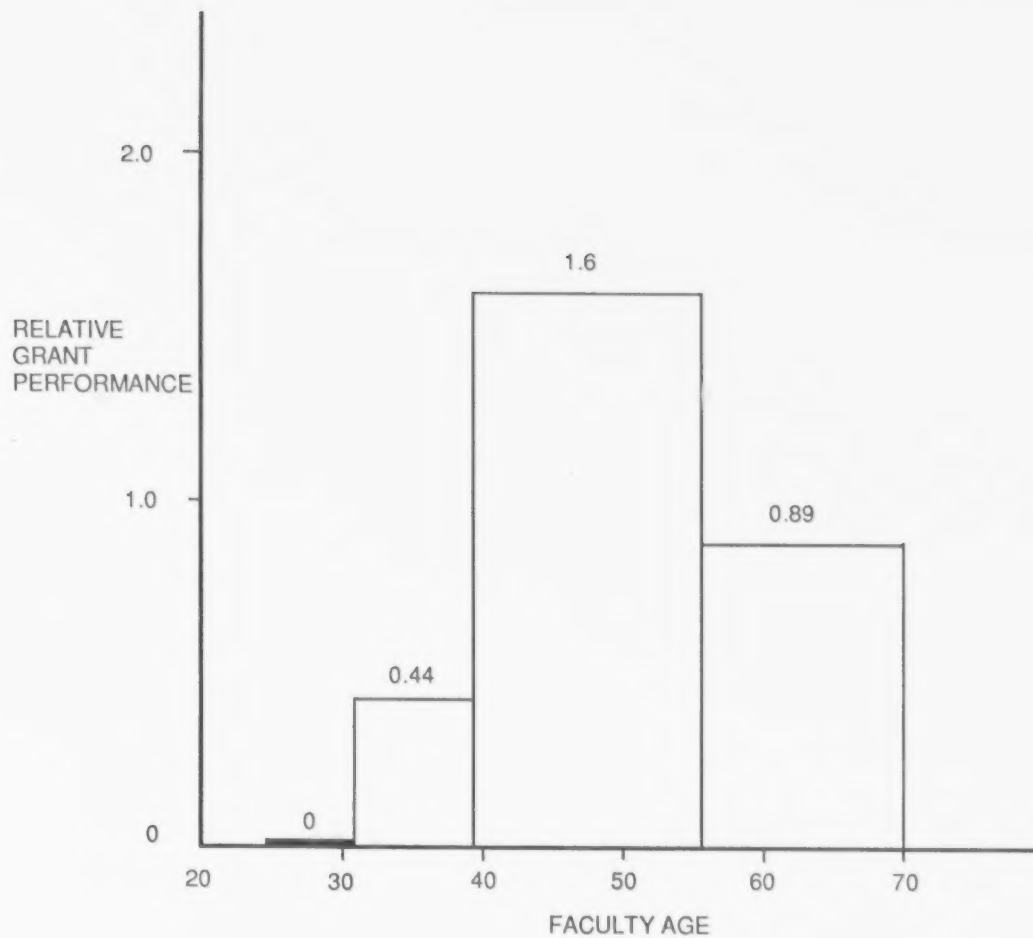


FIGURE 1. Relative faculty average grant performance as a function of age (average performance is set equal to one)

National Reputation

The CWRU School of Medicine, the only medical school in the greater Cleveland area, enjoys a national reputation because of both its educational and research programs. This reputation was viewed by the foundation as being of particular importance since Cleveland had recently suffered a series of losses among its other major industries.

Relationship between the School and the Local Health Industry

A number of the major hospitals in Cleveland are critically dependent upon the vigor and reputation of the School of Medicine for the recruitment of high quality attending staff physicians (who are also faculty of the School) and house staff. The basic biomedical science departments of the School, including those being targeted for revitalization, form the educational and research backbone for many of the clinical care, education, and applied clinical research activities in the affiliated hospitals.

Potential Economic Impact of New Research Findings

Many of the new technologies arising from biomedical research, such as gene splicing, have enormous commercial potential. The possibilities for regional development of industrial ventures based on such findings are greatly enhanced by the proximity of a vigorous basic research enterprise and its personnel.

The School Has the Overall Strength and Depth To Take Full Advantage of New Resources

When all of its departments were viewed in aggregate, the School already possessed a large reservoir of scientific talent that was highly competitive for nationally peer reviewed research awards, demonstrating that it had the institutional experience and judgment to recruit competent leaders and

scientists. Clearly, it also had the administrative capacity to manage the resources available to it. The problem was that there were several basic science departments in a state of decline. These operations had to be brought back up to full strength quickly to regain the strong research relationships with the clinical sciences that had contributed to the productivity of the whole enterprise.

Direct Economic Benefit of Venture Capital Investment in the Basic Biomedical Sciences

The research enterprises of the School were clearly of direct major economic benefit to the community. In total, the School's faculty generated over \$25,000,000 per year of externally acquired research funding. Virtually all of those funds were spent locally for salaries, supplies, and services. The rationale proposed to the foundation was that both initial one-time investments and an increase in annual operating budget to each of the targeted departments were necessary to achieve sustained increases in funded research performance. The increases in competitively earned external research funding would be much greater than the startup funds and incremental budget increases, thereby yielding a substantial return on the investment. This phenomenon was analyzed and graphically demonstrated through the use of a simulation model, the latest version of which is detailed in the following section. The results were a key element in discussions with the foundation.

Methodology

The net financial impact on the School of alternate revitalization scenarios was evaluated utilizing a system dynamics simulation model (Richardson and Pugh, 1981). The system dynamics approach was chosen since

it is particularly useful for investigating system behavior over time, and how that behavior changes in response to various stimuli.

Consisting of approximately 110 variables, operating in a like number of equations, the model is programmed in a special purpose system dynamics language known as "STELLA" (Richmond, 1985), and runs on Apples's Macintosh computer. Model parameters were based on university accounting data and experience gained from an earlier redevelopment of two research oriented departments. Some of the parameters were not derived from exact historical data, but rather were estimated based on the judgment of experienced individuals. This approach was used, for example, to determine the relationship between the level of research equipment available and an individual faculty member's ability to generate research funds. Even though not quantitatively exact, such relationships must be incorporated since models useful for strategic planning need to focus more on system behavior than on point estimation, and depend more on complete representation than on numeric precision. As stressed by Richardson and Pugh (1981), "The premise is that dynamic behavior is a consequence of system structure" (p.15).

The model can be viewed as having three distinct sections - faculty, finances, and capital.

Faculty Sector

Figure 2 is an overview showing the key elements in the faculty sector. The model includes the four age distinct cohorts of faculty shown earlier in Figure 1. Faculty in each cohort accumulate via hiring, and exit via leaving the institution or by aging to the next cohort. There is a separate "cost of hiring" factor and "leave ratio" applied to each cohort. The cost of hiring values (which range from \$25,000 to \$150,000 depending on the level of

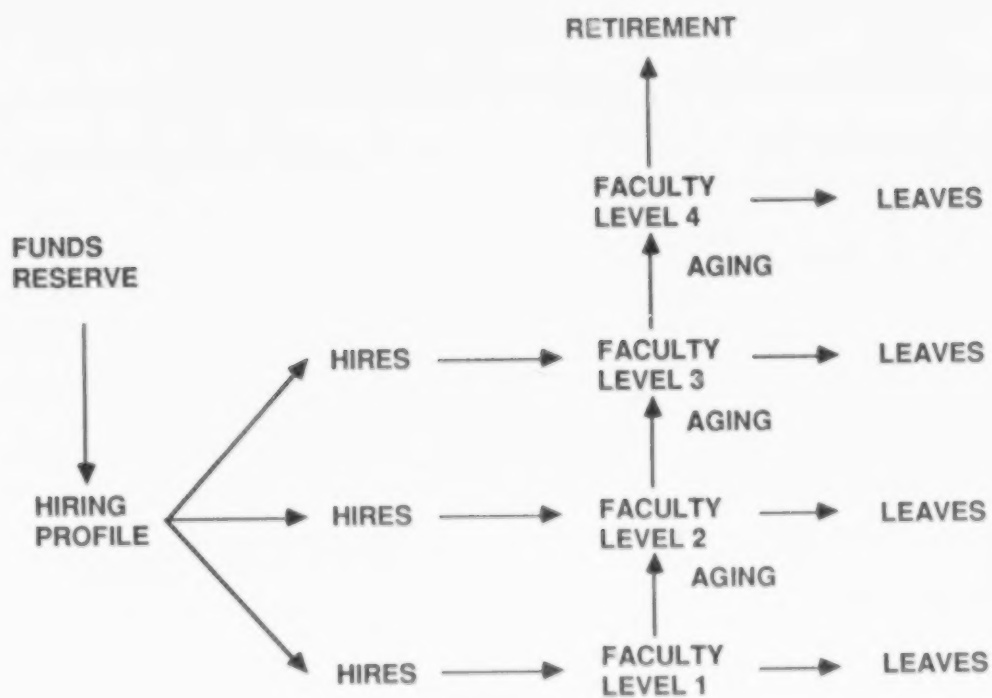


FIGURE 2. Model faculty sector

faculty being recruited) include expenses for recruitment, equipment, staff and supplies to accommodate reestablishment of the individual's research program at our institution. The leave ratios for each cohort were derived as part of a previous study (Kutina, Bruss, Carver, and Polmar, 1979).

The model determines the number and type of faculty to be hired into each cohort (hiring profile) as a function of the level of funds in the funds reserve. If the funds reserve is low, the model will shift the hiring profile to a more junior, and less costly, level of faculty. As the fund reserve grows, the profile is shifted toward more established faculty who generate more research funding quickly. The model assumes that there will not be any hiring into the oldest level of faculty.

Financial Sector

Figure 3 shows the relationships of the main elements included in the income and expense sectors of the model, each sector being primarily driven by the number of faculty. The age profile of the faculty generates a level of research funding (tempered by the level of research equipment available), which in turn produces indirect cost expense and income. The model calculates a number of students (predominately graduate students in this setting), who generate tuition income, as a function of total faculty. Departmental startup funds and budget allocation are set by the user. The net financial impact of altering these last two variables forms the basis of the analyses.

Receipt of research income generates some incremental expense. That is, a fixed proportion of that income is expended on additional staff and non-salary items. In addition, there is a component of the staff and non-salary expenses which is a direct function of the total number of

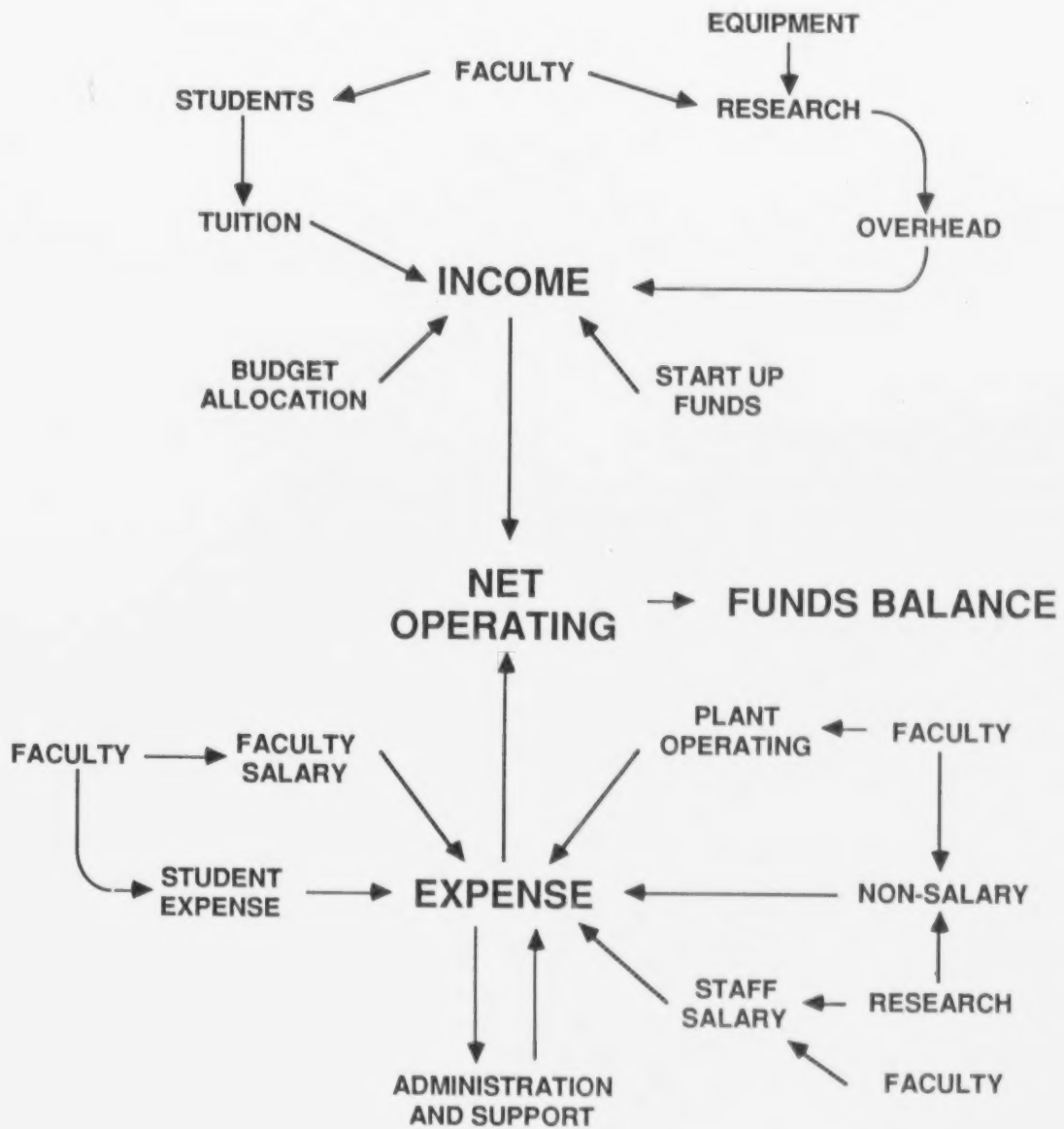


FIGURE 3. Model financial sector

faculty. Other expense items which are indirectly related to faculty include annual space costs (utilities and routine maintenance), and student expense (scholarships and stipends). As more faculty are hired, more space is required, and more graduate students are enrolled. The model derives administrative costs as a function of the total direct expenses of the department.

Capital Sector

The central element of the capital sector (Figure 4) is the accumulated level of dollars in the funds reserve, which is increased or decreased by the net of annual operating income and expenses. Those items which deplete the funds balance include the cost of new hires, space renovation, and new equipment acquisition.

The current number of faculty determines desired levels of equipment and space. Dollars are drawn from the funds reserve for space renovation and equipment purchases if these variables depreciate to levels below normative standards. As the number of faculty changes, the quantities of space and equipment required change, and the model will renovate space and purchase equipment to the extent required. If the amount of space falls below what is necessary to support the current level of faculty, the rate at which faculty can be hired will decline. Given adequate space and funds reserve, the model will hire faculty, although a two year delay in faculty hiring is incorporated to allow for recruitment and contractual obligations. As noted earlier the hiring profile of the faculty is a function of the level of the funds reserve. In addition to funds from the reserve, the equipment level is also increased by a percentage of research funds generated, and a portion of the expenses allocated for new hires.

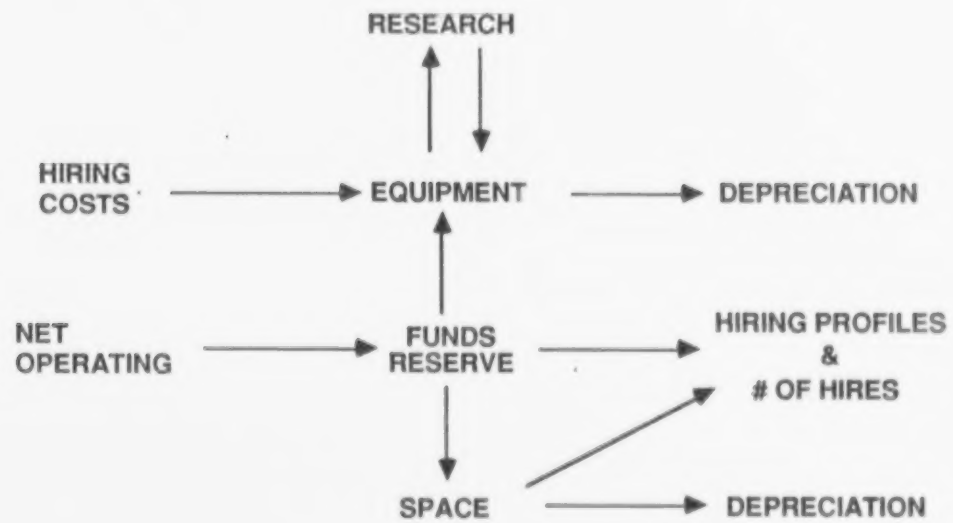


FIGURE 4. Model capital sector

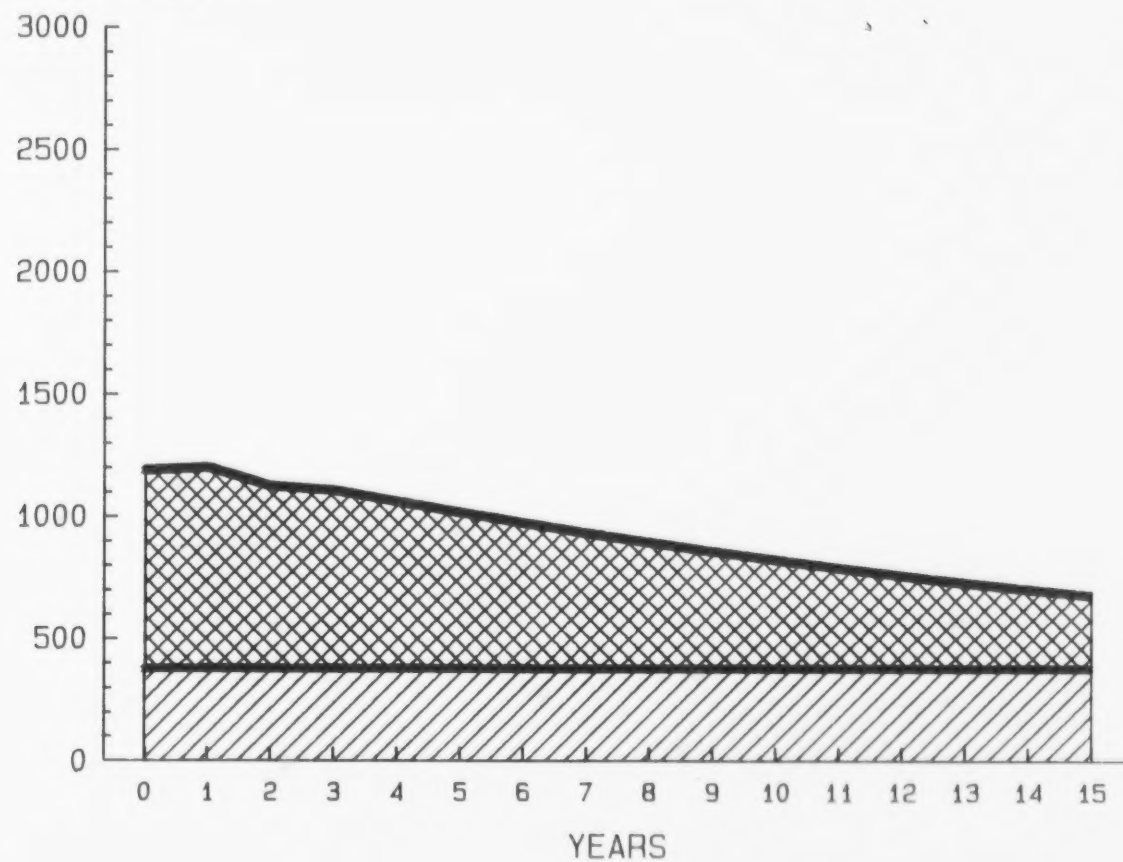
Results

The model described in the previous section was used to evaluate the impact, in terms of external funds generated, resulting from alternate levels of investment in a simulated department. The return was viewed as the research and tuition income generated by departmental activities, while investment was the annual operating budget allocated by the School plus any initial influx of nonrecurring startup dollars. A planning horizon of 15 years was selected as being appropriate for this study. For simplicity, inflation was not incorporated in the simulations. At "time zero" in the model, the department was in a moderately deteriorated condition. It was top heavy with senior faculty, and the state of its research equipment was below par, although it did have adequate research space in good condition.

The base scenario (case 1) involved maintaining the operating allocation at the level in effect at the time of the study, with no initial startup funds allocated. Figure 5 portrays the departmentally generated income in this case and shows a continuation of the decline which already was being experienced in the department being analyzed. The department in this scenario is approaching an equilibrium at a level substantially below the initial conditions. Over the 15 years simulated, the total external funds generated by the department amounts to 1.47 times the School's investment.

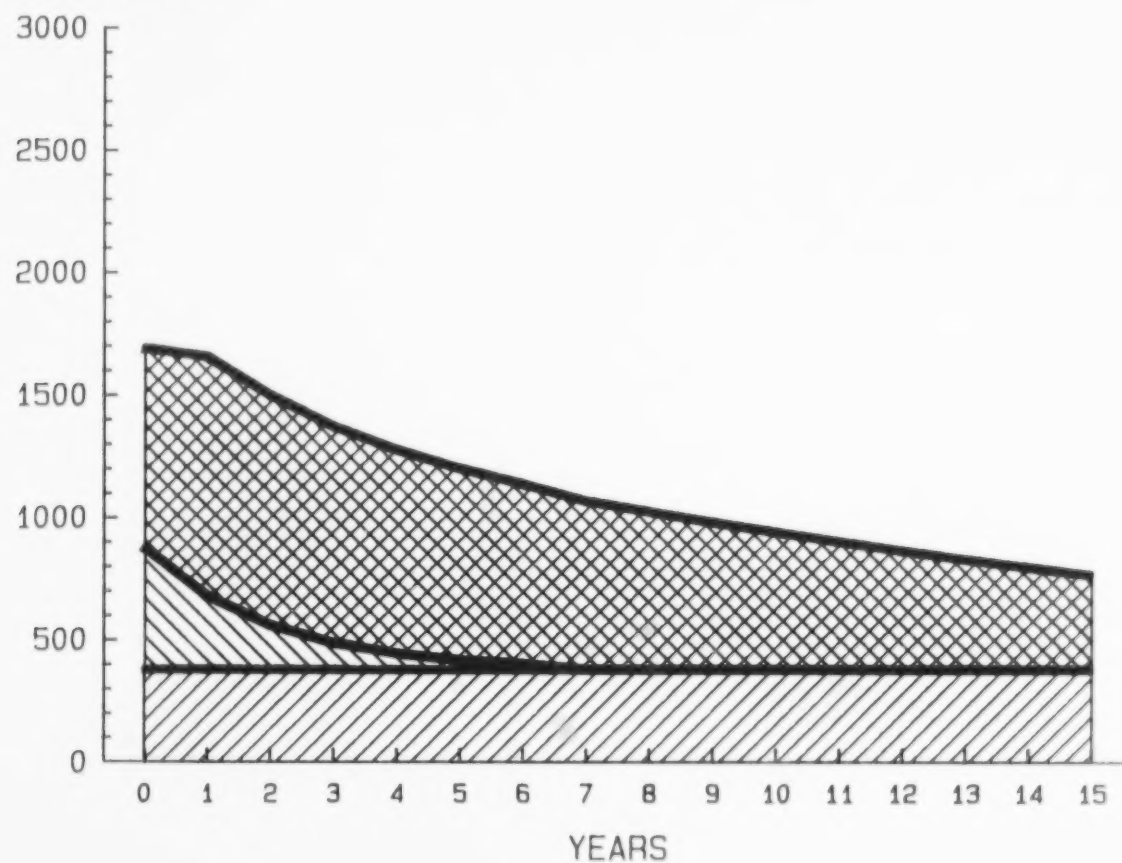
In case 2, the base budget was held constant as it was previously, but the department was provided a one-time stimulus of \$1,000,000 which was placed in its funds reserve over the first few years to be used as needed. This influx of funds allowed the department to upgrade its equipment and hire some new faculty, both of which yielded an early response in terms of departmentally generated income. As shown in Figure 6, the improvement

\$ IN THOUSANDS



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\$ IN THOUSANDS



DEPARTMENTALLY
GENERATED INCOME

STARTUP FUNDS

BUDGET ALLOCATION

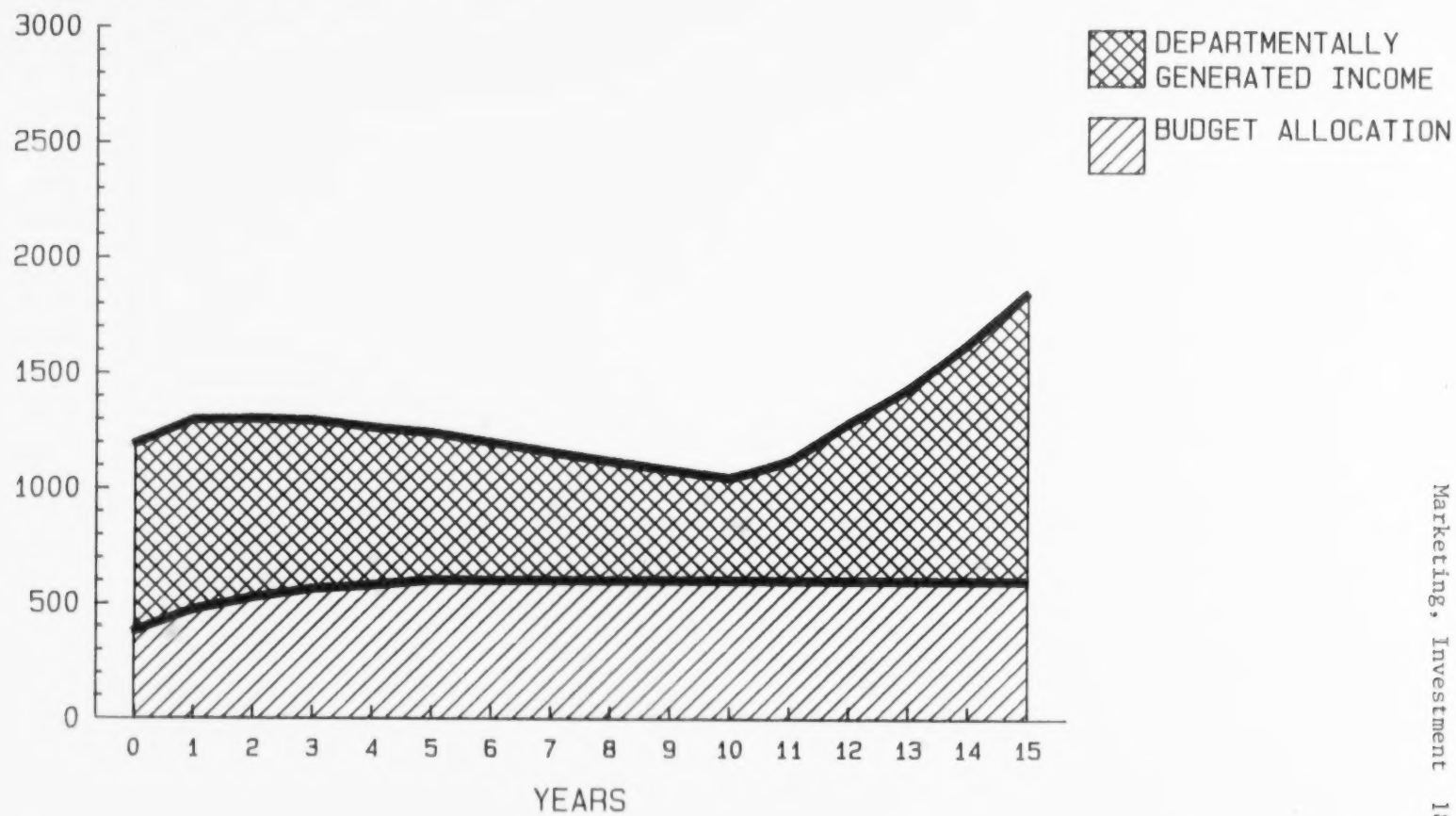
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gradually faded, and the unit resumed its decline as it tried to operate under the fixed operating allocation with which it began. The total return in departmentally generated income over the 15 year simulation was 1.48 times the total institutional investment, essentially the same as in case 1.

The next case (3) involved gradually increasing the School's operating allocation from \$375,000 per year to a new steady state level of \$600,000 per year. No initial startup funds were allocated. Figure 7 shows that after a substantial period of time (approximately 10 years) the departmentally generated income began to respond with a sharp increase. The long lag was the time the simulated department required to bring its research equipment up to standard, to build an adequate funds reserve to start hiring, and for new faculty to come on board and begin generating research awards. In spite of the growth in the latter part of the simulated period, the total externally generated funds were only 1.25 times the School's investment - less than in the base case. Based on results to the fifteen year planning horizon, the return on investment from gradually increasing the department's operating budget does not justify the added cost.

Case 4 combines the initial use of a startup fund as in case 2 with the increased operating allocation of case 3. The results are displayed in Figure 8. The compound impact is apparent. These simulations clearly show that an initial influx of startup funds, and an increased annual operating budget result in a rapid increase in research productivity to a significantly higher steady state. The startup supplies the necessary funds to bring equipment up to standard quickly and to increase the funds reserve to allow optimal faculty hiring, while the increased operating allocation provides for

\$ IN THOUSANDS



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\$ IN THOUSANDS

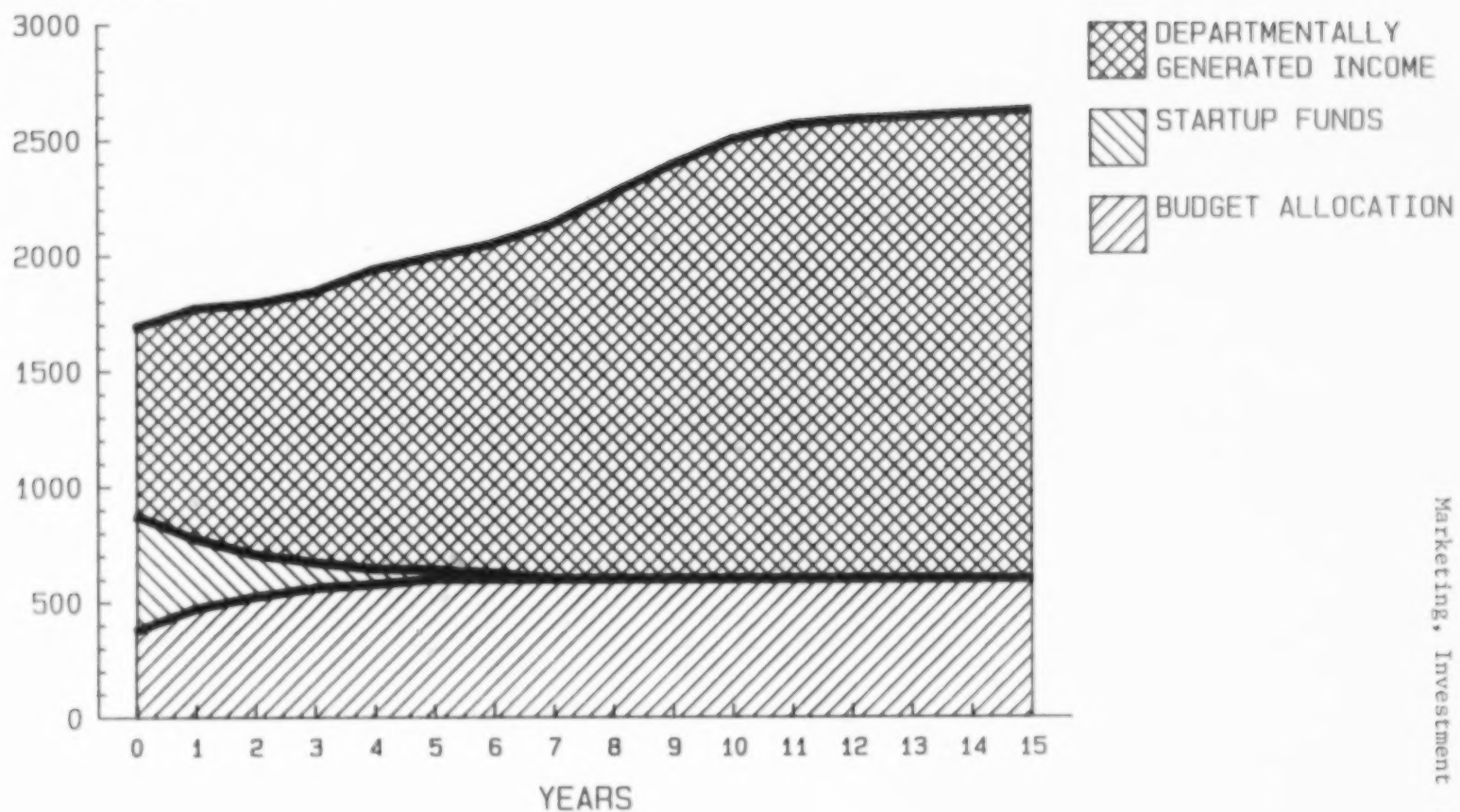


FIGURE 8. Departmental income by source - case 4

sustained growth. Given both sources, the department returns 2.42 times the total investment over the 15 year simulation.

Conclusions

As a result of the rationale and analyses described in this paper the foundation that was approached provided a significant share of the startup funds required for the School of Medicine to revitalize four of its basic science departments. The School via a separate development campaign and reallocation of its unrestricted funds is also increasing operating budgets for the targeted departments. Actual performance to date is compatible with the simulation results.

The School's success in this endeavor supports Ralph Davis' view:

An institution in renewal is in a position to attract significant outside funds, because it gives the major foundations and endowments an exceptional opportunity to help education make a vital transition. The close cooperation of the foundations with the colleges and universities that have a vision and the will to pursue it can turn education around and significantly enhance the possibility of not only surviving the future but of saving those things in the world that we value most. (1985, pp.11-12).

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